Paradox and Theoretical Viability: Diagnosing Inferential Boundaries in Scientific Reasoning

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Author accepted manuscript. Accepted for publication in *Synthese*. This version is prior to copyediting, typesetting, and assignment of the final DOI. The final published version will include the journal-required declarations.

Abstract

Paradoxes are often treated as uniform indicators of theoretical failure or inconsistency. This paper argues that such a view obscures important differences in how paradoxes affect scientific reasoning. It proposes a diagnostic framework that evaluates paradoxes in terms of their impact on inferential viability, understood as the capacity of a framework to sustain stable and non-trivial inferential operations. On this basis, a distinction is developed between collapse-type paradoxes, which undermine the stability of core inferential processes, and persistence-type paradoxes, which generate tension between distinct inferential roles without compromising the operational coherence of the framework. The distinction is illustrated through a comparative analysis of the liar paradox and the old evidence paradox. The former exemplifies a case in which truth-theoretic inference becomes unstable, thereby motivating structural revision of the underlying framework. The latter reflects a misalignment between probabilistic updating and explanatory evaluation, yet leaves inferential practices intact. This contrast demonstrates that paradoxes differ not merely in logical form, but in the way they constrain inferential activity. The paper argues that recognizing these differences has important implications for theory choice. Collapse-type paradoxes exert revisionary pressure on theoretical frameworks, whereas persistence-type paradoxes call for conceptual differentiation or coordination among multiple inferential standards. By reframing paradox in terms of inferential viability, the analysis provides a more precise account of how paradoxes shape the limits and development of theoretical reasoning.

Keywords

Paradox; Inferential viability; Theory choice; Inferential pluralism; Scientific reasoning; Semantic paradox; Confirmation theory; Theoretical viability; Inferential boundaries

1. Introduction

Paradoxes occupy a central yet conceptually unsettled position in the philosophy of science and logic. They are often taken to signal theoretical failure, conceptual tension, or unresolved inconsistency. From semantic paradoxes in formal logic to confirmation paradoxes in epistemology, paradoxes appear at points where established frameworks encounter resistance (Beall, 2009; Crupi, 2025; Priest, 2006; Rescher, 2001). Recent work has further emphasized the diversity of roles that paradoxes play across domains, ranging from challenges to semantic theories of truth to tensions within probabilistic and explanatory reasoning (Beall, 2009; Crupi, 2025; Fitelson, 2001). However, the philosophical significance of paradox remains unclear. Some paradoxes prompt systematic revision of underlying theories, while others persist without undermining the ongoing practice of reasoning. This variation suggests that paradoxes do not exert a uniform kind of pressure on theoretical frameworks.

This paper addresses a question that has not been sufficiently clarified in existing discussions: under what conditions does a paradox indicate a breakdown of a framework, and under what conditions does it instead reveal a limit within which reasoning remains viable? Much of the literature approaches paradoxes in terms of their resolvability, particularly within debates on confirmation theory and probabilistic updating, where paradoxes are often treated as problems requiring formal resolution or theoretical refinement (Crupi, 2025; Fitelson, 2001; Glymour, 1980). While this orientation has generated important insights, it tends to obscure differences in how paradoxes affect the operation of inferential practices. In particular, it leaves underexplored the possibility that some paradoxes may persist without indicating any failure in the underlying framework.

The present analysis proposes a different perspective. Paradoxes are often treated as a homogeneous class, yet this assumption proves inadequate when classification relies solely on logical form or the presence of contradiction. Instead, the analysis examines their impact on the stability of inferential operations within a framework. The central claim is that paradoxes can be distinguished according to whether they undermine the conditions under which core inferential practices can be stably executed. This distinction is not reducible to whether a paradox generates formal inconsistency. Instead, it concerns whether the framework continues to support operations such as truth evaluation, inference licensing, and semantic grounding in a coherent and non-trivial manner. In this respect, the argument departs from approaches that treat inconsistency as the primary indicator of theoretical breakdown (Beall, 2009; Field, 2008). The contribution of this paper is not to introduce a new class of paradoxes, but to provide a diagnostic criterion that reinterprets existing distinctions in terms of inferential viability.

On this basis, the paper introduces a diagnostic distinction between collapse-type and persistence-type paradoxes. Collapse-type paradoxes arise when the introduction of a paradox renders core inferential operations unstable within the framework. In such cases, inferential practices cannot be consistently maintained without structural modification. By contrast, persistence-type paradoxes arise when distinct inferential roles or evaluative tasks become misaligned within a framework that remains operationally viable. Here, reasoning continues to function, even though unresolved tension persists between different inferential standards. This distinction draws on contrasts implicit in the literature between semantic paradoxes that motivate revision of logical systems and epistemic tensions that arise within otherwise stable inferential practices (Beall, 2009; Crupi, 2025; Fitelson, 2001; Glymour, 1980; Kripke, 1975).

This distinction is developed through a comparative analysis of two well-known cases. The liar paradox serves as an example of collapse-type paradox. Its significance lies not merely in the presence of contradiction, but in the way it disrupts the possibility of stable truth attribution within a semantic system (Beall, 2009; Kripke, 1975; Tarski, 1956). The resulting instability affects the execution of truth-theoretic inferential operations within that system, even though everyday reasoning outside this domain remains unaffected. The old evidence paradox, by contrast, illustrates a persistence-type case. It reflects a structural misalignment between probabilistic updating and explanatory evaluation, a tension that has been extensively analyzed in work on Bayesian confirmation and the problem of old evidence (Crupi, 2025; Fitelson, 2001; Garber, 1983; Glymour, 1980). Bayesian reasoning remains internally coherent, and scientific reasoning proceeds without interruption, yet the tension between different inferential roles persists.

The aim of this analysis is diagnostic rather than reconstructive. The paper does not propose a new logical system or a revised theory of confirmation. Nor does it seek to resolve specific paradoxes. Instead, it develops a framework for distinguishing how different paradoxes constrain inferential practice and, in doing so, clarifies their role in theory choice. In particular, it suggests that paradoxes should be evaluated in terms of their impact on inferential viability rather than solely in terms of their formal structure or their resistance to resolution. This orientation aligns with broader developments in the philosophy of science that emphasize inferential pluralism and the coexistence of multiple evaluative standards within scientific reasoning (Chang, 2012; Hacking, 1983; van Fraassen, 1989).

This approach builds on and extends several strands of existing work. In philosophical logic, paradoxes have been treated as motivations for revising semantic or logical principles, including hierarchical theories of truth and non-classical logics (Beall, 2009; Kripke, 1975; Priest, 2006; Tarski, 1956). In epistemology and philosophy of science, paradoxes such as the old evidence problem have prompted refinements in accounts of confirmation and explanation (Crupi, 2025; Fitelson, 2001; Garber, 1983; Glymour, 1980). More broadly, discussions of theory choice and scientific reasoning have emphasized the plurality of inferential standards and the importance of context-sensitive evaluation (Chang, 2012; Hacking, 1983; van Fraassen, 1989). However, there is

no general framework that distinguishes how different paradoxes constrain inferential practice across these domains. The present account seeks to fill this gap by providing a unified diagnostic perspective.

Two clarifications are important for situating the scope of the proposal. First, the analysis operates at the level of inferential structure and is not intended to provide an exhaustive account across all descriptive or representational levels. Paradoxes may arise from linguistic, cognitive, or contextual factors that are not directly addressed here. Second, the account treats paradoxes as arising within specific frameworks rather than as intrinsic features of phenomena. A paradox may dissolve under a shift in perspective or representational regime. However, this does not negate its diagnostic significance within the framework in which it arises. The classification proposed here is therefore framework-relative and concerns the stability of inferential operations given the resources available within a particular system.

Within this framework, paradoxes can be understood as boundary markers of inferential practice. Collapse-type paradoxes indicate points at which the framework fails to sustain its own inferential operations, thereby motivating structural revision. Persistence-type paradoxes, by contrast, mark limits of applicability in which different inferential roles coexist without full integration. In such cases, the appropriate response may involve differentiating evaluative tasks rather than imposing a single unified resolution.

Semantic paradoxes and confirmation paradoxes are typically discussed within separate subfields, with the former motivating revision of logical systems and the latter prompting refinements in probabilistic epistemology. When these cases are considered in relation to theory choice, however, they are seldom compared as instances of a broader category. This separation has left underexamined the question of whether paradoxes constrain inferential practice in fundamentally different ways. Where broader claims about the role of paradox in theory choice do appear, they often rely on an implicit and insufficiently articulated assumption that paradoxes uniformly indicate a need for theoretical revision. This account makes this assumption explicit and argues that it fails to capture the diversity of inferential constraints exhibited by different types of paradox.

While recent discussions of paradox have emphasized domain-specific analyses in logic and epistemology, the present account seeks to provide a cross-domain diagnostic framework grounded in inferential viability. By focusing on the stability of inferential operations rather than on formal properties alone, it aims to articulate a distinction that is often implicit in existing discussions but insufficiently developed at a general level.

The remainder of the paper develops this diagnostic perspective in detail. Section 2 analyzes the liar paradox and specifies the mechanism by which it disrupts the stability of truth-theoretic inference. Section 3 examines the old evidence paradox and shows how it reflects a misalignment between explanatory and confirmatory roles without compromising inferential viability. Section 4 draws out

the broader implications of this distinction for theory choice, inferential pluralism, and the boundaries of scientific reasoning.

2. The Liar Paradox and Inferential Instability within Semantic Frameworks

The liar paradox has long occupied a central position in philosophical logic as a paradigmatic case of a semantic paradox. Unlike many puzzles that are described as paradoxical in a loose or metaphorical sense, the liar paradox reveals a structural instability that arises within a truth-theoretic framework itself. Its philosophical significance does not lie in empirical difficulty or explanatory inadequacy, but in the way self-reference interacts with assumptions about truth to undermine the stability of semantic evaluation (Beall, 2009; Kripke, 1975; Tarski, 1956).

The canonical formulation is familiar. Consider the sentence, “This sentence is false.” If the sentence is true, then what it asserts must hold, and it must therefore be false. If it is false, then what it asserts does not hold, and it must therefore be true. This oscillation is generated entirely within the semantic framework. It does not depend on uncertainty, incomplete information, or contextual ambiguity. Rather, it arises from the interaction of three widely accepted assumptions: that sentences may refer to their own truth status, that meaningful declarative sentences are truth-apt, and that truth and falsity are mutually exclusive.

Traditional discussions often emphasize the contradiction generated by this reasoning. However, contemporary work in philosophical logic has shown that inconsistency does not by itself entail inferential collapse (Beall, 2009; Field, 2008; Priest, 2006). For present purposes, the crucial issue is therefore not merely that contradiction arises, but that no stable procedure for assigning truth values can be sustained within the framework. The problem revealed by the liar paradox is therefore not exhausted by inconsistency. Instead, it concerns the absence of a stable assignment relation between sentences and truth values that would allow semantic evaluation to proceed in a determinate and repeatable manner.

This point can be clarified by specifying what is meant by inferential viability in this context. A semantic framework is inferentially viable if it supports the stable execution of core inferential operations, including truth evaluation, inference licensing, and the preservation of non-trivial distinctions between sentences. The liar paradox disrupts these operations at the level of truth-theoretic inference. Attempts to evaluate the truth of the liar sentence do not converge on a determinate outcome. Instead, they generate a cycle that prevents the assignment of a stable truth value. As a result, the inferential role of truth predicates within the system becomes unstable.

Importantly, this instability is domain-specific. It does not imply that all forms of reasoning are undermined. Everyday reasoning, mathematical inference, and many forms of scientific reasoning remain unaffected. The collapse concerns truth-theoretic inferential practices within the semantic system itself. In this sense, the liar paradox does not show that reasoning as such is impossible, but that a particular inferential subsystem fails to sustain its own operations under the given assumptions.

This perspective also clarifies why the liar paradox motivates structural revision. Classical responses, such as hierarchical theories of truth, restrict the conditions under which sentences may refer to their own truth status (Tarski, 1956). Kripke's fixed point approach modifies assumptions about truth-value determinacy by allowing partial interpretations (Kripke, 1975). Non-classical approaches, including dialetheism, revise underlying logical principles in order to accommodate inconsistency without trivialization (Beall, 2009; Field, 2008; Priest, 2006). Despite their differences, these approaches share a common feature. They do not merely eliminate contradiction. They restore the possibility of stable inferential operations by redefining the conditions under which truth evaluation can be carried out.

The significance of these responses lies in the kind of theoretical pressure exerted by the paradox. The liar paradox generates a situation in which the existing framework cannot sustain a stable procedure for semantic evaluation. Maintaining inferential viability therefore requires modification of the framework itself. In this sense, the paradox functions as a collapse-type case. It marks a point at which the inferential resources of the system are insufficient to support their own operation. The failure is thus not merely a feature of particular sentences, but a structural limitation of the inferential system under the given semantic assumptions.

The present claim is more specific than the general observation that inconsistency need not entail inferential collapse. In the case of the liar paradox, the relevant instability arises from the interaction between self-reference and truth attribution within a given semantic framework. It is this interaction, rather than inconsistency alone, that disrupts the stability of inferential operations.

The liar paradox thus serves as a benchmark for understanding collapse-type paradoxes. It illustrates a situation in which inferential viability is compromised because core operations cannot be stably executed within the framework. This stands in contrast to cases in which paradoxical tension arises without undermining the operational coherence of the system. In such cases, which will be examined in the next section, the issue is not the breakdown of inferential operations but the misalignment between distinct inferential roles.

3. The Old Evidence Paradox and Inferential Misalignment

The old evidence paradox occupies a distinctive position in the philosophy of science. Unlike semantic paradoxes that challenge the stability of truth attribution, the old evidence paradox arises within a framework that remains inferentially coherent and operational. Its significance does not lie in the generation of contradiction, but in the tension that emerges when different inferential roles are brought into relation within a single evaluative context (Crupi, 2025; Fitelson, 2001; Garber, 1983; Glymour, 1980).

The paradox is typically formulated in temporal terms. A body of evidence is already known at a given time, and a new theory is later proposed that successfully explains this evidence. Intuitively, it appears that the explanatory success of the theory provides support for it. However, within standard Bayesian conditionalization, this intuition cannot be straightforwardly accommodated. Since the evidence is already known, its probability is equal to one, and conditionalizing on it cannot increase the probability of the theory. From the perspective of probabilistic updating, the evidence does not confirm the theory, a result that has been widely discussed and refined in contemporary confirmation theory (Crupi, 2025; Fitelson, 2001; Glymour, 1980).

What is philosophically significant in this case is not a failure of the probabilistic framework, but a misalignment between distinct inferential roles. Probabilistic updating and explanatory evaluation operate under different constraints and serve different functions within scientific reasoning. Probabilistic updating concerns how rational agents revise their degrees of belief in light of new information. Explanatory evaluation concerns how well a theory accounts for and organizes a body of phenomena. The paradox arises when these two roles are treated as interchangeable within a single evaluative framework, a tension that has been noted in discussions of the relationship between explanation and confirmation (Crupi, 2025; Fitelson, 2001; Garber, 1983).

This misalignment does not undermine the stability of inferential operations within the system. Bayesian reasoning continues to function as a coherent and well-defined method for updating beliefs (Howson & Urbach, 1993). At the same time, explanatory reasoning continues to play a central role in scientific practice. The tension between them does not prevent either form of inference from operating. Rather, it reflects the coexistence of multiple inferential standards that are not fully reducible to one another. In this sense, inferential viability is preserved.

The mechanism underlying this persistence-type paradox can be understood as a form of inferential role conflation. The paradox does not arise from instability within any single inferential operation, but from the attempt to evaluate explanatory success using a framework designed for belief updating. When explanatory and confirmatory roles are distinguished, the apparent conflict can be resolved or at least reinterpreted, a strategy that has been explored in contemporary analyses of

Bayesian confirmation. This suggests that the paradox is not intrinsic to the phenomena themselves, but depends on the evaluative perspective adopted (Chang, 2012; van Fraassen, 1989).

This perspective-dependent character is crucial for situating the scope of the analysis. The paradox arises within a framework that imposes a specific structure on the relation between evidence and theory. Under alternative frameworks that treat explanation and confirmation as distinct evaluative dimensions, the tension may be significantly reduced or even disappear (Chang, 2012; van Fraassen, 1989). However, this does not render the paradox philosophically insignificant. Within the original framework, it functions as a diagnostic indicator of the limits of applying a single inferential standard across different epistemic tasks.

In this respect, the old evidence paradox exemplifies a persistence-type case. It marks a boundary of applicability rather than a breakdown of inferential structure. The framework remains capable of supporting stable inferential operations, yet the attempt to extend a single evaluative schema across multiple roles generates tension. The appropriate response in such cases is not necessarily structural revision, but conceptual differentiation. Distinguishing between inferential roles allows the framework to retain its operational coherence while accommodating the plurality of evaluative practices.

This stands in contrast to collapse-type paradoxes, where the inferential system itself fails to sustain its operations. In the case of the old evidence paradox, no such failure occurs. Instead, the paradox reveals the limits of a particular mode of evaluation and highlights the need for a more differentiated account of scientific reasoning. It is precisely this capacity for continued operation in the presence of unresolved tension that characterizes persistence-type paradoxes.

4. Inferential Viability and the Differentiation of Paradox

The analyses of the liar paradox and the old evidence paradox reveal a systematic contrast that cannot be adequately captured by treating paradoxes as a homogeneous class or by existing distinctions based solely on logical form or inconsistency. In the former case, the paradox undermines the stability of core inferential operations within a semantic framework. In the latter, inferential practices remain intact, yet tension arises from the interaction of distinct evaluative roles.

To articulate this difference in a more general and theoretically informative way, it is necessary to move beyond case-based analysis and introduce a framework for evaluating the impact of paradoxes on inferential practice. The central proposal developed in this section is that paradoxes can be systematically distinguished in terms of their effect on inferential viability, understood as the capacity of a framework to sustain stable and non-trivial inferential operations. This perspective allows for a unified account of the contrast identified in the preceding sections while avoiding the assumption that paradoxes uniformly signal theoretical failure.

4.1 Inferential Viability as a Diagnostic Criterion

The analysis developed in the preceding sections suggests that paradoxes should not be classified solely by their logical form or by the presence of contradiction, but by their impact on the stability of inferential operations within a framework. To articulate this claim in a more general form, it is necessary to clarify what is meant by inferential viability and how it functions as a diagnostic criterion.

For present purposes, inferential failure is understood in a minimal and operational sense. A framework fails inferentially when it cannot sustain a stable procedure for executing its core inferential operations, such as truth assignment, inference licensing, or the preservation of non-trivial distinctions, under its own rules. The liar paradox exemplifies such failure not merely because it generates contradiction, but because it blocks the possibility of any determinate and repeatable assignment of truth values within the system. The resulting instability affects the inferential role of truth predicates, even though other forms of reasoning outside this subsystem remain unaffected.

A framework can be said to be inferentially viable when it supports the stable and non-trivial execution of its core inferential operations. These operations include, but are not limited to, the assignment and evaluation of truth values, the licensing of inferences, and the preservation of distinctions between meaningful claims. Stability in this context refers to the capacity of these operations to yield determinate and repeatable outcomes under the rules of the system. Non-triviality refers to the preservation of meaningful inferential distinctions, such that not all statements become derivable or indistinguishable. Together, these conditions specify a minimal sense in which a framework remains operational as a site of reasoning.

This characterization departs from approaches that treat inconsistency as the primary indicator of theoretical breakdown. Contemporary work in philosophical logic has shown that the presence of inconsistency does not, by itself, entail inferential collapse. Paraconsistent logics, for example, allow certain contradictions to be accommodated without trivializing the system or rendering inference meaningless (Beall, 2009; Field, 2008; Priest, 2006). From this perspective, inconsistency is neither a sufficient nor a necessary condition for the failure of inferential practice. What matters, rather, is whether the inferential mechanisms of the framework can continue to function in a stable and non-degenerate manner.

The notion of inferential viability thus provides a more fine-grained diagnostic tool for evaluating the impact of paradoxes. Instead of asking whether a paradox generates contradiction, the relevant question becomes whether it disrupts the operational conditions under which inferential practices are sustained. A paradox that undermines the stability of truth evaluation or inference licensing compromises inferential viability and thereby exerts pressure toward structural revision. By

contrast, a paradox that leaves these operations intact, even while introducing tension between different evaluative roles, does not threaten the framework's capacity to function.

This shift in focus aligns with broader developments in the philosophy of science that emphasize the evaluation of theories in terms of their inferential and problem-solving capacities rather than their formal properties alone. Accounts of scientific reasoning have increasingly highlighted the plurality of inferential standards and the context-dependent nature of theoretical assessment (Chang, 2012; Fitelson, 2001; Hacking, 1983; van Fraassen, 1989). Within this perspective, the presence of unresolved tension does not automatically count against a framework, provided that its inferential practices remain operationally coherent.

At the same time, the proposed criterion is not intended to provide an exhaustive account of all dimensions along which paradoxes may be evaluated. The analysis operates at the level of inferential structure and abstracts from linguistic, cognitive, and pragmatic factors that may also contribute to the emergence of paradox. Inferential viability should therefore be understood as a framework-relative notion. Its application depends on the inferential resources and evaluative standards internal to a given system. A paradox may compromise viability within one framework while remaining unproblematic within another.

In this sense, inferential viability functions not as a classificatory label applied to paradoxes as intrinsic entities, but as a diagnostic lens for assessing the conditions under which reasoning can be sustained. By shifting attention from logical form to operational stability, it becomes possible to distinguish between paradoxes that exhaust the inferential resources of a framework and those that merely reveal the limits of applying a unified evaluative scheme across distinct inferential domains.

4.2 Two Modes of Inferential Constraint

If inferential viability provides the relevant criterion for assessing the impact of paradoxes, then the distinction introduced in the preceding sections can be reformulated in more general terms as a distinction between two modes of inferential constraint. Paradoxes do not uniformly disrupt reasoning; rather, they constrain inferential practice in qualitatively different ways depending on how they interact with the operational structure of a framework.

The first mode may be described as collapse-type constraint. In such cases, the paradox undermines the stability of core inferential operations within the framework. The conditions required for truth evaluation, inference licensing, or semantic grounding can no longer be satisfied in a determinate and repeatable manner. As a result, inferential activity within the affected subsystem cannot be stably maintained. This does not entail that all reasoning collapses, but it does indicate that the relevant inferential structure fails to sustain its own operation under the given assumptions. Classical treatments of the liar paradox exemplify this mode, insofar as they motivate revision of

semantic or logical principles in order to restore operational coherence (Beall, 2009; Field, 2008; Kripke, 1975).

The second mode may be described as persistence-type constraint. Here, paradox arises not from the breakdown of inferential operations, but from a misalignment between distinct inferential roles or evaluative standards within a framework. Different inferential practices, such as probabilistic updating and explanatory assessment, remain individually stable and operational, yet their interaction generates tension when treated as instances of a single evaluative schema. The resulting paradox does not prevent reasoning from proceeding, but it exposes the limits of integrating heterogeneous inferential functions within a unified framework. Contemporary discussions of confirmation theory and explanatory reasoning provide several instances of this kind of tension, particularly in the context of Bayesian approaches (Crupi, 2025; Fitelson, 2001).

This distinction between modes of constraint clarifies why paradoxes exert different kinds of theoretical pressure. Collapse-type paradoxes call into question the adequacy of the inferential machinery itself and therefore motivate structural revision of the framework. Persistence-type paradoxes, by contrast, do not necessarily require revision of underlying principles. Instead, they often motivate conceptual differentiation, such as distinguishing between inferential roles or restricting the scope of particular evaluative standards. In this respect, the appropriate response to a paradox depends on the kind of constraint it imposes rather than on its logical form alone.

Importantly, the distinction does not track the presence or absence of inconsistency. As argued in Section 4.1, the relevant question is whether a paradox destabilizes the operational conditions of inference within the framework.

The two modes of constraint can also be understood in terms of the different ways in which paradoxes delimit the space of possible reasoning. Collapse-type paradoxes exhaust the inferential resources of a subsystem, leaving no stable procedure for continuing the relevant form of inference without modification. Persistence-type paradoxes, by contrast, reveal boundaries within which multiple inferential practices coexist without full integration. In such cases, the inferential space is not exhausted but differentiated, and reasoning proceeds by navigating the tensions between distinct evaluative perspectives.

This formulation aligns with broader perspectives in the philosophy of science that emphasize the plurality of inferential standards and the context-sensitivity of theoretical evaluation. Scientific reasoning often involves the coordination of heterogeneous inferential practices that cannot be reduced to a single unified criterion (Chang, 2012; Hacking, 1983; van Fraassen, 1989). From this standpoint, paradoxes can be seen as points at which such coordination becomes problematic, either because the underlying inferential structure fails or because the integration of distinct inferential roles exceeds the capacity of a given framework.

Recasting paradoxes in terms of modes of inferential constraint thus provides a more precise account of their philosophical significance. It explains why some paradoxes function as triggers for structural revision, while others persist as indicators of the limits of theoretical integration. This distinction, grounded in inferential viability, allows for a more nuanced understanding of how paradoxes shape the development and evaluation of theoretical frameworks.

4.3 Implications for Theory Choice

Recasting paradoxes in terms of modes of inferential constraint has direct implications for how they bear on theory choice. Traditional discussions often treat paradoxes as uniformly exerting pressure toward revision, assuming that the presence of paradox indicates a deficiency in the theoretical framework. This assumption is evident in both logical and epistemological contexts, where paradoxes are frequently taken to motivate changes in underlying principles, whether through modifications of semantic hierarchies, revisions of logical laws, or refinements in confirmation theory (Beall, 2009; Field, 2008; Fitelson, 2001). While such responses are sometimes warranted, the analysis developed here suggests that they are not universally appropriate.

The distinction between collapse-type and persistence-type constraints implies that paradoxes do not exert a uniform kind of revisionary pressure. Collapse-type paradoxes indicate that the inferential machinery of a framework fails to sustain its own operation. In these cases, theory choice is indeed driven toward structural revision, since the preservation of inferential viability requires modification of the underlying system. This dynamic is well illustrated in the history of responses to semantic paradoxes, where the instability of truth-theoretic inference has led to the development of hierarchical semantics, partial truth theories, and non-classical logics (Beall, 2009; Field, 2008; Kripke, 1975).

Persistence-type paradoxes, by contrast, do not undermine the operational coherence of the framework. Instead, they reveal tensions between distinct inferential roles that coexist within the same system. In such cases, the presence of paradox does not by itself justify structural revision. Rather, it motivates a more differentiated approach to theory evaluation, in which the plurality of inferential standards is explicitly acknowledged. Contemporary work in confirmation theory illustrates this point. Debates surrounding the old evidence paradox have led not to the abandonment of Bayesian reasoning, but to refinements in how explanatory considerations are related to probabilistic updating (Crupi, 2025; Fitelson, 2001; Garber, 1983; Glymour, 1980). The framework remains viable, even as its internal structure is rendered more complex.

This distinction has important consequences for how paradoxes are interpreted within broader accounts of theory choice. Philosophical approaches that emphasize problem-solving effectiveness or inferential performance already recognize that theories may remain acceptable despite unresolved tensions (Hacking, 1983; Laudan, 1977). Similarly, perspectives that stress the plurality of scientific practices highlight the coexistence of multiple evaluative criteria within scientific

reasoning (Chang, 2012; van Fraassen, 1989). The present analysis provides a diagnostic articulation of these insights by specifying the conditions under which paradoxes indicate failure and the conditions under which they mark limits of integration.

In this light, paradoxes can be understood as differentiating, rather than uniformly undermining, theoretical frameworks. Collapse-type paradoxes signal points at which inferential viability cannot be sustained without revision, thereby guiding theory choice toward structural change. Persistence-type paradoxes, by contrast, delineate boundaries within which different inferential roles remain operative but not fully unified. In these cases, theory choice may proceed through strategies of conceptual differentiation, domain restriction, or the coordination of multiple inferential perspectives rather than through wholesale revision.

This perspective also clarifies why attempts to eliminate all paradoxes within a single unified framework may be misguided. If paradoxes arise from fundamentally different modes of inferential constraint, then a uniform strategy of resolution is unlikely to be adequate. Efforts to force persistence-type tensions into a collapse-type model of failure risk obscuring the productive role that such tensions play in sustaining plural forms of reasoning. Conversely, treating collapse-type paradoxes as if they merely reflect benign tensions may underestimate the extent to which they undermine the operational basis of inference.

Understanding paradox in terms of inferential viability thus reframes its role in theory choice. Rather than functioning solely as triggers for revision, paradoxes serve as indicators of how inferential practices are constrained within a framework. They reveal whether a framework must be transformed in order to remain viable, or whether it can continue to operate by accommodating a plurality of inferential roles. In this way, paradoxes contribute to theory choice not by uniformly demanding resolution, but by differentiating the kinds of responses that theoretical frameworks require.

4.4 Scope and Boundary Conditions

The account developed in this paper is intended as a diagnostic framework for evaluating how paradoxes constrain inferential practice. As such, it is important to clarify the scope and boundary conditions under which the proposed distinction between collapse-type and persistence-type constraints is meant to apply. These clarifications concern the level of analysis, the status of paradox as a phenomenon, and the conditions under which the classification remains stable.

First, the analysis operates at the level of inferential structure. It focuses on the stability and interaction of inferential operations such as truth evaluation, inference licensing, and probabilistic updating. This level of analysis abstracts from other dimensions that may contribute to the emergence of paradox, including linguistic ambiguity, cognitive processing, and pragmatic context. Such factors have been extensively discussed in the literature on scientific reasoning and model-

based inference, where the behavior of agents and representational practices may shape how paradoxes are formulated and interpreted (Hacking, 1983; Weisberg, 2013). The present framework does not deny the relevance of these factors, but treats them as external to the inferential conditions that determine whether a framework remains operational.

Second, the account treats paradoxes as framework-dependent rather than as intrinsic features of phenomena. A paradox arises within a specific configuration of assumptions, inferential rules, and evaluative standards. As a result, the same underlying situation may or may not generate a paradox depending on how it is represented. This perspective is consistent with approaches in the philosophy of science that emphasize the role of models, representations, and conceptual schemes in structuring scientific problems (Chang, 2012; van Fraassen, 1989). From this standpoint, the classification proposed here should be understood as relative to the inferential resources available within a given framework. A paradox that produces collapse-type constraint in one framework may appear as a persistence-type tension or may not arise at all in another.

Third, the distinction between modes of inferential constraint is most clearly applicable in contexts where a single inferential framework is under consideration. In practice, however, scientific reasoning often involves the interaction of multiple frameworks or representational regimes. In such cases, paradoxical tension may arise not from instability within a single framework, but from misalignment across distinct inferential systems. For example, conflicts between probabilistic and explanatory reasoning can be interpreted either as internal tensions within a unified framework or as artifacts of coordinating different evaluative practices (Crupi, 2025; Fitelson, 2001; Garber, 1983). When multiple frameworks are in play, the classification between collapse-type and persistence-type constraints may shift depending on how the boundaries of the system are drawn.

This observation suggests that the proposed distinction is not absolute, but conditional on how inferential domains are specified. The diagnostic value of the framework lies in its ability to make explicit the assumptions under which a given paradox is evaluated. By identifying whether inferential instability arises within a framework or whether tension emerges from the interaction of distinct inferential roles, the analysis helps to clarify the source of the paradox and the range of appropriate responses.

These boundary conditions also bear on the interpretation of theoretical change. In cases of collapse-type constraint, revision is directed toward restoring the operational integrity of the framework. In cases of persistence-type constraint, adjustment may take the form of differentiating inferential roles, restricting domains of application, or coordinating multiple evaluative standards. The framework does not prescribe a single response, but provides a way of diagnosing which kinds of responses are warranted under different conditions.

The proposed account should therefore be understood not as a comprehensive taxonomy of paradoxes, but as a context-sensitive tool for analyzing the limits of inferential practice. Its scope is

restricted to the evaluation of inferential viability within specified frameworks, and its conclusions are conditioned by how those frameworks are defined. Within these limits, the distinction between collapse-type and persistence-type constraints offers a systematic way of interpreting the role of paradox in shaping the development and assessment of theoretical systems.

5. Conclusion

This paper has argued that paradoxes should not be treated as a homogeneous class uniformly indicative of theoretical failure. Instead, it has proposed a diagnostic framework that evaluates paradoxes in terms of their impact on inferential viability, understood as the capacity of a framework to sustain stable and non-trivial inferential operations. On this basis, a distinction was developed between collapse-type and persistence-type modes of inferential constraint.

Collapse-type paradoxes arise when the inferential mechanisms of a framework cannot be stably maintained under the assumptions that generate the paradox. In such cases, the paradox signals a failure of the framework to sustain its own operations, thereby motivating structural revision. Persistence-type paradoxes, by contrast, arise from tensions between distinct inferential roles within a framework that remains operationally coherent. These paradoxes do not undermine inferential viability, but instead mark limits in the integration of heterogeneous evaluative standards.

The significance of this distinction lies in its implications for how paradoxes bear on theory choice. Rather than uniformly demanding resolution or revision, paradoxes exert differentiated forms of theoretical pressure. Collapse-type cases call for transformation of the inferential structure in order to restore viability. Persistence-type cases, by contrast, invite strategies of conceptual differentiation, domain restriction, or coordination among multiple inferential perspectives. Recognizing this difference helps to clarify why some paradoxes lead to systematic theoretical change, while others persist as stable features of ongoing scientific reasoning.

More broadly, the account contributes to philosophical discussions of scientific reasoning by reframing paradox as a diagnostic phenomenon. Paradoxes do not merely challenge theories; they reveal how inferential practices are structured and where their limits lie. In this sense, paradoxes function as indicators of the conditions under which reasoning can be sustained within a framework. This perspective aligns with approaches that emphasize the plurality of inferential standards and the context-dependent character of theory evaluation (Chang, 2012; Fitelson, 2001; Hacking, 1983; van Fraassen, 1989).

At the same time, the scope of the proposed framework is intentionally limited. The analysis operates at the level of inferential structure and treats paradoxes as arising within specific frameworks rather than as intrinsic features of phenomena. The distinction between collapse-type and persistence-type constraints is therefore framework-relative and sensitive to how inferential

domains are specified. In contexts involving multiple interacting frameworks, paradoxical tension may arise from misalignment across distinct inferential systems rather than from instability within a single framework. These boundary conditions do not undermine the diagnostic value of the account, but they delimit the contexts in which it is intended to apply.

Taken together, the analysis suggests that the philosophical role of paradox is best understood not in terms of resolution alone, but in terms of the ways in which paradoxes constrain and differentiate inferential practice. By shifting attention from logical form to operational stability, the framework developed here provides a more nuanced basis for interpreting how paradoxes shape the development and evaluation of theoretical systems.

References

Beall, J. C. (2009). *Spandrels of truth*. Oxford University Press.

Chang, H. (2012). *Is water H2O? Evidence, realism and pluralism*. Springer.

Crupi, V. (2025). Confirmation. In E. N. Zalta & U. Nodelman (Eds.), *The Stanford Encyclopedia of Philosophy* (Fall 2025 ed.). Metaphysics Research Lab, Stanford University. https://plato.stanford.edu/archives/fall2025/entries/confirmation/

Fitelson, B. (2001). A Bayesian account of independent evidence with applications. *Philosophy of Science, 68*(3), S123–S140. https://doi.org/10.1086/392903

Field, H. (2008). *Saving truth from paradox*. Oxford University Press.

Garber, D. (1983). Old evidence and logical omniscience in Bayesian confirmation theory. In J. Earman (Ed.), *Testing scientific theories* (pp. 99–131). University of Minnesota Press.

Glymour, C. (1980). *Theory and evidence*. Princeton University Press.

Hacking, I. (1983). *Representing and intervening: Introductory topics in the philosophy of natural science*. Cambridge University Press.

Howson, C., & Urbach, P. (1993). *Scientific reasoning: The Bayesian approach* (2nd ed.). Open Court.

Kripke, S. A. (1975). Outline of a theory of truth. *The Journal of Philosophy*, *72*(19), 690–716. https://doi.org/10.2307/2024634

Laudan, L. (1977). *Progress and its problems: Toward a theory of scientific growth*. University of California Press.

Priest, G. (2006). *In contradiction: A study of the transconsistent* (2nd ed.). Oxford University Press.

Rescher, N. (2001). *Paradoxes: Their roots, range, and resolution*. Open Court.

Tarski, A. (1956). *Logic, semantics, metamathematics: Papers from 1923 to 1938* (J. H. Woodger, Trans.). Oxford University Press.

van Fraassen, B. C. (1989). *Laws and symmetry*. Oxford University Press.

Weisberg, M. (2013). *Simulation and similarity: Using models to understand the world*. Oxford University Press.